74LVC125A-Q100

Quad buffer/line driver with 5 V tolerant inputs/outputs; 3-state

Rev. 2 — 5 May 2020

Product data sheet

1. General description

The 74LVC125A-Q100 consists of four non-inverting buffers/line drivers with 3-state outputs (nY) that are controlled by the output enable input (nOE). A HIGH at nOE causes the outputs to assume a high-impedance OFF-state.

Inputs can be driven from either 3.3~V or 5~V devices. When disabled, up to 5.5~V can be applied to the outputs.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- 5 V tolerant inputs/outputs for interfacing with 5 V logic
- Wide supply voltage range from 2.3 V to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- Complies with JEDEC standard:
 - JESD8-7A (1.65 V to 1.95 V)
 - JESD8-5A (2.3 V to 2.7 V)
 - JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
- · Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

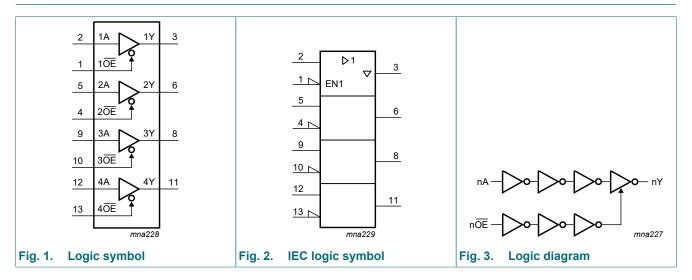
3. Ordering information

Table 1. Ordering information

Type number	Package									
	Temperature range	Name	Description	Version						
74LVC125AD-Q100	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1						
74LVC125APW-Q100	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1						
74LVC125ABQ-Q100	-40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm	SOT762-1						

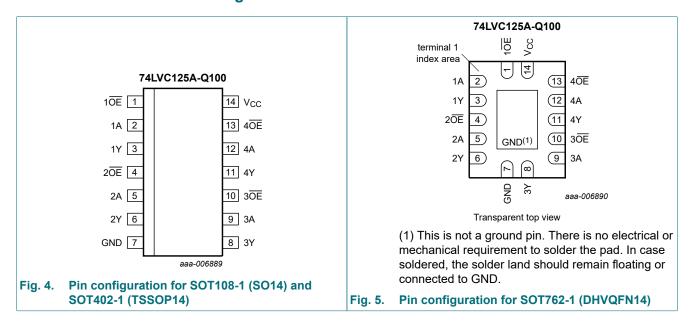


4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
10E, 20E, 30E, 40E	1, 4, 10, 13	data enable input (active LOW)
1A, 2A, 3A, 4A	2, 5, 9, 12	data input
1Y, 2Y, 3Y, 4Y	3, 6, 8, 11	data output
GND	7	ground (0 V)
V _{CC}	14	supply voltage

6. Functional description

Table 3. Function selection

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state

Inputs nOE		Output		
nŌE	nA	nY		
L	L	L		
L	Н	Н		
Н	X	Z		

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	+6.5	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
VI	input voltage	[1]	-0.5	+6.5	V
I _{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0 V$	-	±50	mA
Vo	output voltage	output HIGH or LOW-state [2]	-0.5	V _{CC} + 0.5	V
		output 3-state [2]	-0.5	+6.5	V
Io	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I _{CC}	supply current		-	100	mA
I _{GND}	ground current		-100	-	mA
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$ [3]	-	500	mW
T _{stg}	storage temperature		-65	+150	°C

^[1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V _{CC}	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
VI	input voltage		0	-	5.5	V
Vo	output voltage	output HIGH or LOW state	0	-	V _{CC}	V
		output 3-state	0	-	5.5	V
T _{amb}	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.3 V to 2.7 V	0	-	20	ns/V
		V _{CC} = 2.7 V to 3.6 V	0	-	10	ns/V

^[2] The output voltage ratings may be exceeded if the output current ratings are observed.

^[3] For SOT108-1 (SO14) package: P_{tot} derates linearly with 10.1 mW/K above 100 °C.

For SOT402-1 (TSSOP14) package: Ptot derates linearly with 7.3 mW/K above 81 °C.

For SOT762-1 (DHVQFN14) package: Ptot derates linearly with 9.6 mW/K above 98 °C.

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40	°C to +85	s °C	-40 °C to	Unit	
			Min	Typ [1]	Max	Min	Max	
V _{IH}	HIGH-level input	V _{CC} = 1.2 V	1.08	-	-	1.08	-	V
	voltage	V _{CC} = 1.65 V to 1.95 V	0.65V _{CC}	-	-	0.65V _{CC}	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V_{IL}	LOW-level input	V _{CC} = 1.2 V	-	-	0.12	-	0.12	V
	voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35V _{CC}	-	0.35V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V _{OH}	HIGH-level	V _I = V _{IH} or V _{IL}						
	output voltage	$I_O = -100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	V _{CC} - 0.2	-	-	V _{CC} - 0.3	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	-	-	1.05	-	V
		I_{O} = -8 mA; V_{CC} = 2.3 V	1.8	-	-	1.65	-	V
		I_{O} = -12 mA; V_{CC} = 2.7 V	2.2	-	-	2.05	-	V
		I _O = -18 mA; V _{CC} = 3.0 V	2.4	-	-	2.25	-	V
		I_{O} = -24 mA; V_{CC} = 3.0 V	2.2	-	-	2.0	-	V
V_{OL}	LOW-level	V _I = V _{IH} or V _{IL}						
	output voltage	I _O = 100 μA; V _{CC} = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	-	0.65	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.6	-	0.8	V
		I_{O} = 12 mA; V_{CC} = 2.7 V	-	-	0.4	-	0.6	V
		I_{O} = 24 mA; V_{CC} = 3.0 V	-	-	0.55	-	0.8	V
I _I	input leakage current	$V_{CC} = 3.6 \text{ V}; V_I = 5.5 \text{ V or GND}$	-	±0.1	±5	-	±20	μΑ
I _{OZ}	OFF-state output current	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 3.6 \text{ V}; $ $V_O = 5.5 \text{ V or GND}$	-	±0.1	±5	-	±20	μΑ
I _{OFF}	power-off leakage current	$V_{CC} = 0.0 \text{ V}; V_{I} \text{ or } V_{O} = 5.5 \text{ V}$	-	±0.1	±10	-	±20	μΑ
I _{CC}	supply current	V_{CC} = 3.6 V; V_I = V_{CC} or GND; I_O = 0 A	-	0.1	10	-	40	μΑ
ΔI _{CC}	additional supply current	per input pin; $V_1 = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 2.7 \text{ V}$ to 3.6 V	-	5	500	-	5000	μΑ
Cı	input capacitance	V_{CC} = 0 V to 3.6 V; V_I = GND to V_{CC}	-	4.0	-	-	-	pF

^[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 8.

Symbol	Parameter	Conditions		-40	°C to +85	°C	-40 °C to	+125 °C	Unit
				Min	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Fig. 6	[2]						
		V _{CC} = 1.2 V		-	12.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V		1.5	5.4	11.0	1.5	12.8	ns
		V _{CC} = 2.3 V to 2.7 V		1.0	2.9	5.7	1.0	6.7	ns
		V _{CC} = 2.7 V		1.5	2.8	5.5	1.5	7.0	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	2.5	4.8	1.0	6.0	ns
t _{en}	enable time	nOE to nY; see Fig. 7	[2]						
		V _{CC} = 1.2 V		-	16.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V		1.0	5.0	12.2	1.0	14.2	ns
		V _{CC} = 2.3 V to 2.7 V		0.5	2.9	6.8	0.5	7.9	ns
		V _{CC} = 2.7 V		1.5	3.1	6.6	1.5	8.5	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	2.3	5.4	1.0	7.0	ns
t _{dis}	disable time	nOE to nY; see Fig. 7	[2]						
		V _{CC} = 1.2 V		-	7.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V		2.2	4.6	7.5	2.2	8.7	ns
		V _{CC} = 2.3 V to 2.7 V		0.5	2.6	4.2	0.5	5.0	ns
		V _{CC} = 2.7 V		1.5	3.1	5.0	1.5	6.5	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	3.2	4.6	1.0	6.0	ns
t _{sk(o)}	output skew time	V _{CC} = 3.0 V to 3.6 V	[3]	-	-	1.0	-	1.5	ns
C _{PD}	power dissipation	per buffer; V_I = GND to V_{CC}	[4]						
	capacitance	V _{CC} = 1.65 V to 1.95 V		-	6.0	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V		-	9.4	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V		-	12.4	-	-	-	pF

^[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

 t_{en} is the same as t_{PZL} and $t_{\text{PZH}}.$

 t_{dis} is the same as t_{PLZ} and $t_{\text{PHZ}}.$

 f_i = input frequency in MHz; f_o = output frequency in MHz

C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

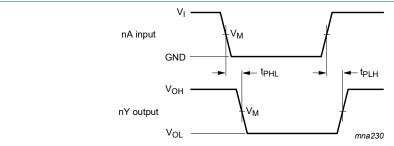
N = number of inputs switching

 $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

t_{pd} is the same as t_{PLH} and t_{PHL}.

Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design. C_{PD} is used to determine the dynamic power dissipation (P_D in μ W). $P_D = C_{PD} \times {V_{CC}}^2 \times f_i \times N + \Sigma (C_L \times {V_{CC}}^2 \times f_o)$ where:

10.1. Waveforms and test circuit



Measurement points are given in Table 8.

 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 6. The input nA to output nY propagation delays

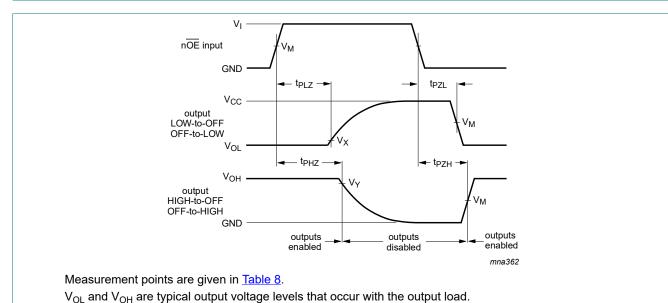
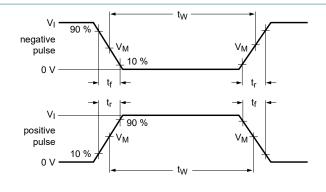
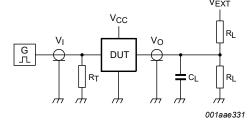


Fig. 7. 3-state enable and disable times

Table 8. Measurement points

Supply voltage	Input		Output					
V _{CC}	V _{CC} V _I		V _M	V _X	V _Y			
1.2 V	V _{CC}	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 0.15 V	V _{OH} - 0.15 V			
1.65 V to 1.95 V	V _{CC}	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 0.15 V	V _{OH} - 0.15 V			
2.3 V to 2.7 V	V _{CC}	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 0.15 V	V _{OH} - 0.15 V			
2.7 V	2.7 V	1.5 V	1.5 V	V _{OL} + 0.3 V	V _{OH} - 0.3 V			
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	V _{OL} + 0.3 V	V _{OH} - 0.3 V			





Test data is given in Table 9.

Definitions for test circuit:

 R_L = Load resistance.

 C_L = Load capacitance including jig and probe capacitance.

 R_T = Termination resistance should be equal to output impedance Z_0 of the pulse generator.

 V_{EXT} = External voltage for measuring switching times.

Fig. 8. Test circuit for measuring switching times

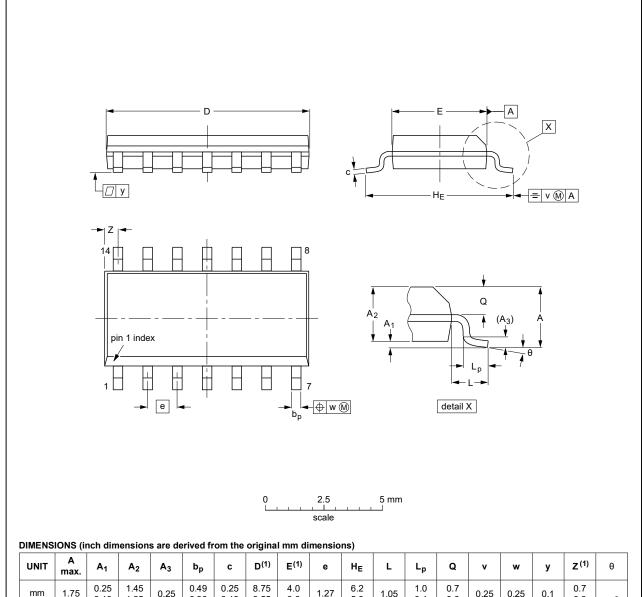
Table 9. Test data

Supply voltage	Input		Load		V _{EXT}	V _{EXT}			
V _{CC}	VI	t _r , t _f	CL	R _L	t _{PLH} , t _{PHL}	t _{PLZ} , t _{PZL}	t _{PHZ} , t _{PZH}		
1.2 V	V _{CC}	≤ 2 ns	30 pF	1 kΩ	open	2 × V _{CC}	GND		
1.65 V to 1.95 V	V _{CC}	≤ 2 ns	30 pF	1 kΩ	open	2 × V _{CC}	GND		
2.3 V to 2.7 V	V _{CC}	≤ 2 ns	30 pF	500 Ω	open	2 × V _{CC}	GND		
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	2 × V _{CC}	GND		
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	2 × V _{CC}	GND		

11. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



	UNIT	A max.	A ₁	A ₂	A ₃	b _p	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	q	v	w	у	Z ⁽¹⁾	θ
	mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8°
iı	nches	0.069	0.010 0.004	0.057 0.049	0.01		0.0100 0.0075	0.35 0.34	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	0°

Note

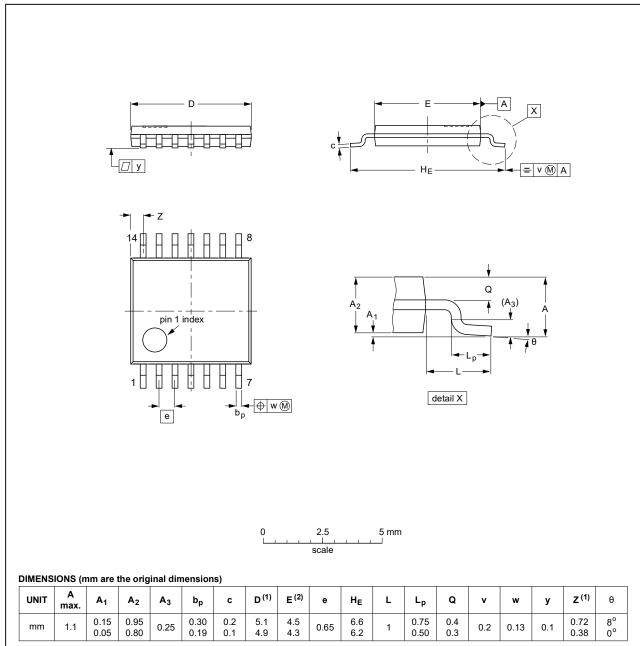
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT108-1	076E06	MS-012				99-12-27 03-02-19

Fig. 9. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT402-1		MO-153				99-12-27 03-02-18

Fig. 10. Package outline SOT402-1 (TSSOP14)

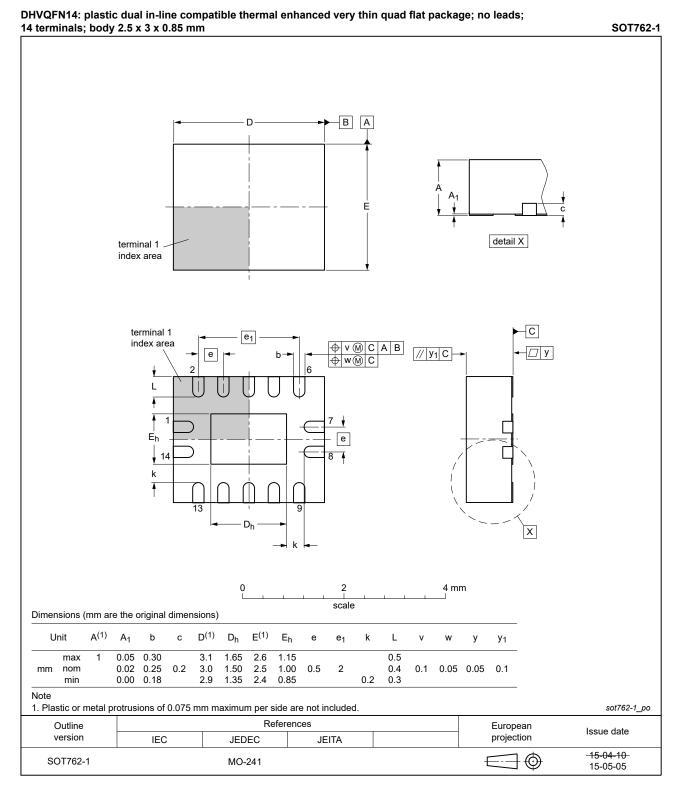


Fig. 11. Package outline SOT762-1 (DHVQFN14)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description	
CMOS	Complementary Metal-Oxide Semiconductor	
DUT	Device Under Test	
ESD	ElectroStatic Discharge	
НВМ	Human Body Model	
MIL	Military	
MM	Machine Model	
TTL	Transistor-Transistor Logic	

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC125A_Q100 v.2	20200505	Product data sheet	-	74LVC125A_Q100 v.1
Modifications:	guidelines of Legal texts Section 2 u Table 4: De Table 8: ad	of this data sheet has been of Nexperia. have been adapted to the pdated. erating values for Ptot total ded measurement points for ckage outline drawing SO	new company nar power dissipation v_X	ne where appropriate.
74LVC125A_Q100 v.1	20130404	Product data sheet	-	-

14. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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